FLUID COMPONENTS INTERNATIONAL LLC

HART Operation Manual

ST100 Series
Thermal Mass Flow Meter

HART COMMUNICATION PROTOCOL

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Introduction

This manual describes the ST100 HART protocol 7.3 features, its operation and configuration. The ST100 can provide up to 4 different process variables. It provides Flow, Temperature, Flow Totalizer, and Pressure, as outputs. The flow output can be selected as Volumetric, Mass or Velocity units. The ST102 and ST112 can support up to two flow sensors and provides the average flow of the two sensors in a single output.

This documents is written to be used with all members of the ST100 product family configured with the HART 7.3 communication Protocol.

The HART output is provided through an extension card that is fully integrated into the ST100 instrument.

Definition

Universal HART Commands

A collection of commands that must be supported by All HART compatible devices. The Universal Command Specification establishes the minimum Application layer support required of all HART devices. The Application layer defines the commands, responses, data types and status reporting supported by the Protocol.

Common Practice HART Commands

A collection of commands applicable to a wide range of devices. These commands shall be supported by devices whenever possible. The HART Common Practice Commands enhances interoperability by providing additional standardized, device-independent commands.

Device Specific Commands

Commands defined by the manufacturer according to the need of the Field device. The manufacturer of the Field device controls these commands. The FCI ST100 family of products has 20 manufacturer specific commands.

EDDL/DD Files

Text files interpreted by the host system. The EDDL file is a file that tells the host what functionality the device (ST100) has, and how the functionality is invoked. The EDDL also tells the host to do common maintenance functions such as calibration, configuration check status of individual sensors, change engineering units, etc.

FCI Configurator

A PC software tool that gives access to the ST100 functions and features. It facilitates basic instrument setup and configuration, as well as advance functions. The FCI configurator can interface through the ST100 USB Service port on the Ethernet Service port.

Installation

General

For details on the general mounting, placement of sensor head and mounting options see the Basic User Manual, 06EN003400.

Electrical Wiring

Access the wiring terminal block by removing the rear electrical connection cover. This cover can be locked closed by the cover locking screw. Release the cover locking screw and remove the cover.

Cable access to wiring connections is obtained through one of the four conduit outlets, see figure 6 below.

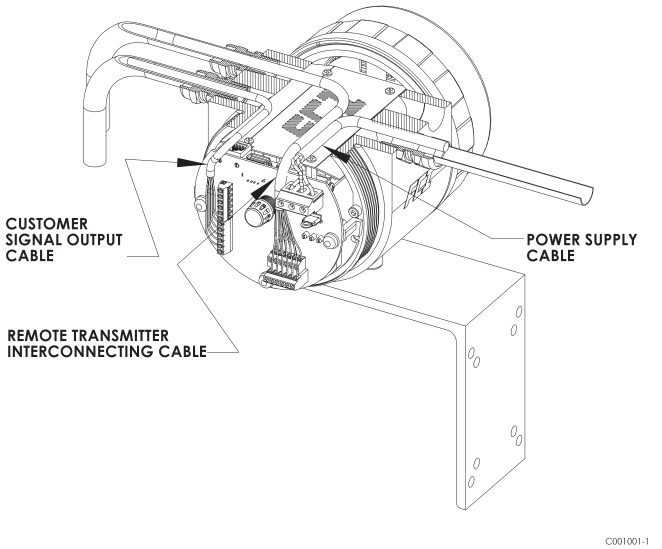


Figure 6 - Instrument Wiring

The HART connections for the ST100 are located in the back panel. The connector for the HART is P1A; the pins are labeled “CH1” and “RTN 1/2”. The ST100 HART connections are non- polarized, but polarity needs to be observed for other manufacturer’s devices. Connect the HART bus cable as noted below. See Appendix A for Channel 1 HART Connections on instruments shippped before April 2012.

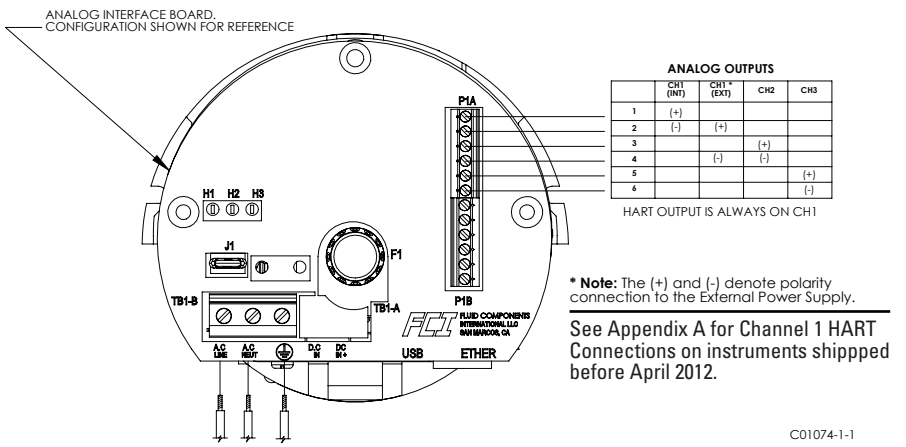


Figure 1 - HART Output Wiring Table

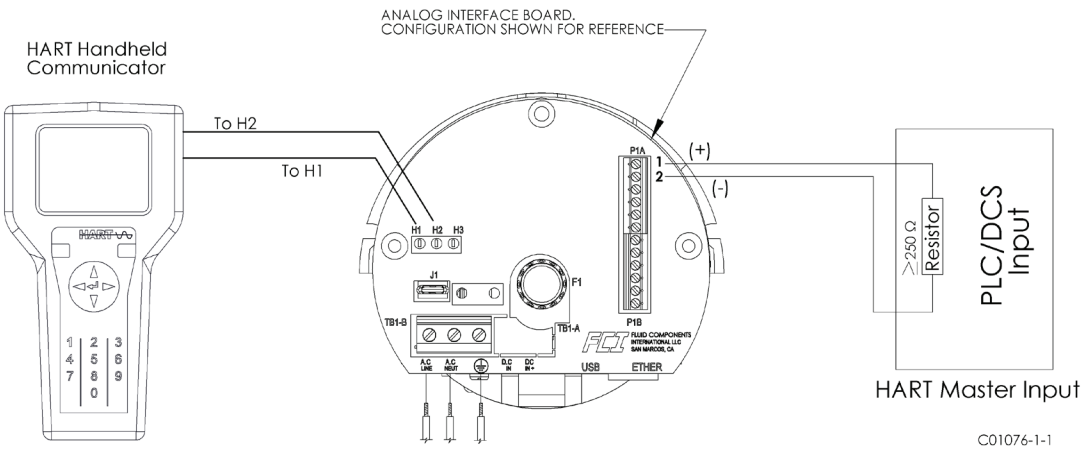


Figure 2 - Detail Internal Power Supply connection for Non-Network

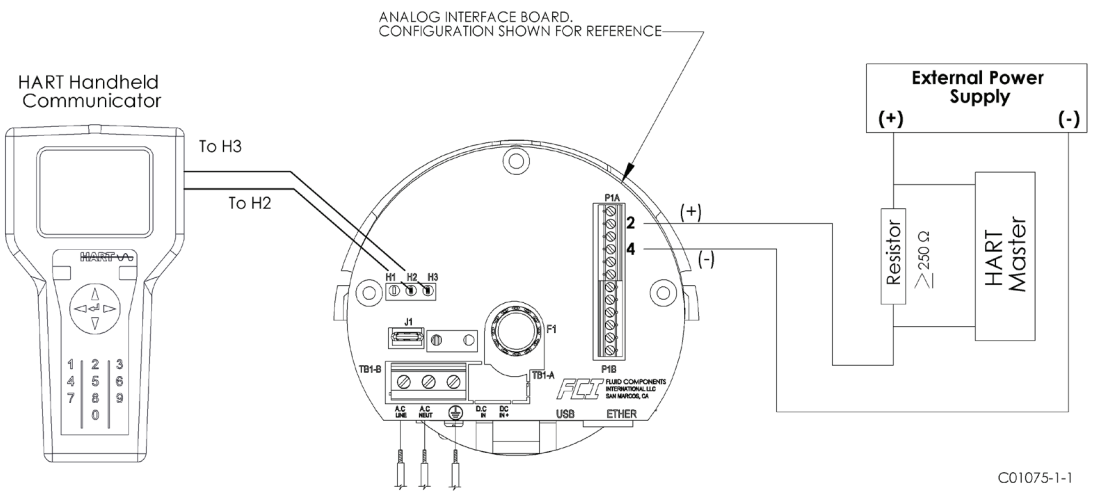


Figure 3 - Detail External Power Supply connection for Non-Network

Topology and Network Configuration

The ST100 supports Multidrop topology. In multidrop operation, the devices exchange data and measured values only via the HART protocol/HART Network. In Network configuration the analog current signal serves just to energize the two-wire devices, providing a current of 4 mA per instrument.

In multidrop mode, up to 15 field devices are connected in parallel to a single wire pair or segment (Figure 4). The host distinguishes the field devices by their preset addresses that range from 1 to 255. The factory preset address is 0.

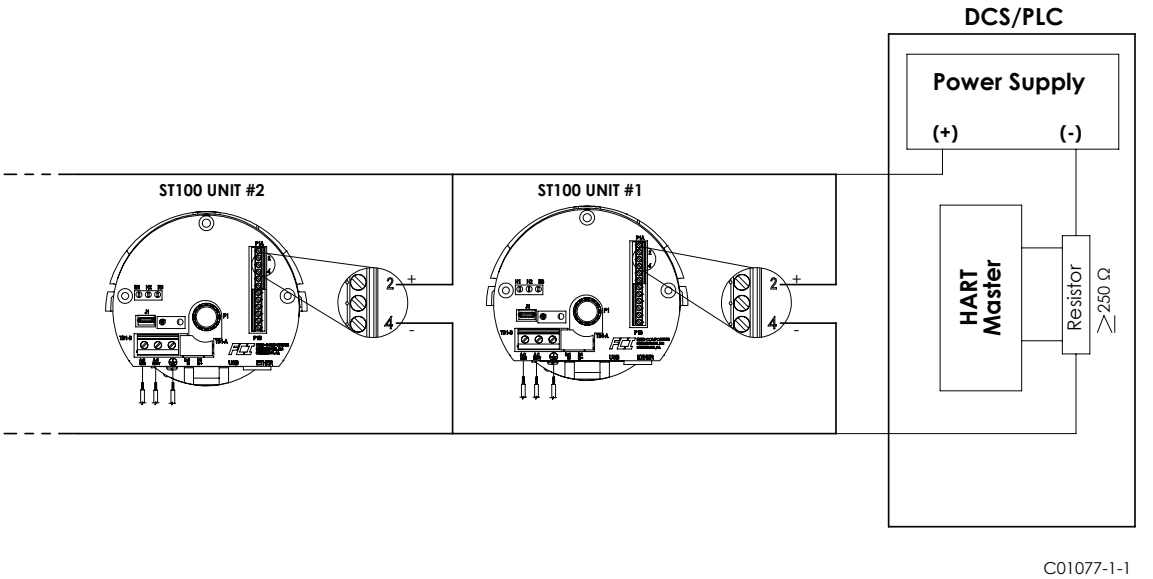


Figure 4 - Multidrop Mode with HART Transmitters

Operation

Functional Description

The primary function of the HART protocol is to present the instruments process data through its process data commands. Command 1, command 3 and command 9.

The ST100 does not implement the HART Burst mode. A HART master that supports HART 7.0 and higher is required. A HART communicator that supports HART 7.0 and higher is required (i.e. Emerson 475 Communicator.)

Process Data Operation

Even though HART 7.0 is compatible with older versions of the HART protocol, the ST100 HART implementation and commands 1 and 3 are still supported, they contain the Flow Variable only, for the full set of Dynamic variables it is recommended that the HART master use command 9 to request process data of dynamic variables and status.

ST100 HART Process Data Organization

It is important to briefly review how the ST100 Process data is organized under the HART command 9. For Details on Command 9 see the HART Specification "Universal Commands Specification" HCF_SPEC-127, Revision 7.1.

Not all the variables described in this section are available in all configurations of the ST100 flow meter. For example not all configurations have Process Pressure, and instruments that output Mass Flow or Volumetric flow , the Flow Totalizer may be turned on or off.

The following are the ST100 process variables that are provided through HART command 9.

There are 3 flow classes or types, and these are "Exclusively OR" meaning that only one class of flow is active at a time.

PROCESS VARIABLE	SLOT #	HART VARIABLE CODE DESCRIPTION	DEVICE VARIABLE CODE	DEVICE VARIABLE CLASSIFICATION
VOLUMETRIC FLOW *	0	PRIMARY VARIABLE	0	66
MASS FLOW *	2	PRIMARY VARIABLE	2	72
VELOCITY FLOW *	4	PRIMARY VARIABLE	4	67
VOLUME (TOTALIZER)	1	SECONDARY VARIABLE	1	68
MASS (TOTALIZER)	3	SECONDARY VARIABLE	3	71
TEMPERATURE	5	TERTIARY VARIABLE	5	64
PRESSURE	6	QUATERNARY VARIABLE	6	65

* Implies an "Exclusive OR" Releationship

Under the "Device Variable Status" parameter, for each process variable, only the four most significant bits are used.

The two most significant bits contain

"Process Data Status": 11 = good
01 = Poor Accuracy
10 = manual/fixed
00 = bad

The two bits after the two most significant contain

"Limit Status": 11 = constant
01 = low limited
10 = high limited
00 = not limited

Device variable status example: 1100XXXX.X, variable values indicated in positions represented by an 'X' can be ignored.

Device Description Files

EDDL Files

TThe ST100 EDDL files are support files that provide an extended description of each object in the Virtual Field Device (VFD), and provide information needed for a control system or host to understand the meaning of the data in the VFD including the human interface. The EDDL file can be thought as a "driver" for the device.

FCI provides two types of files; first the standard EDDL files located in the folder A67F0101, and the Emerson 375 and 475 files located in the folder DDP.

A67F0101Folder:

0101.fm8

A67F0101.ddl

DDP Folder:

00A67F0101.hdd

00A67F0101.hhd

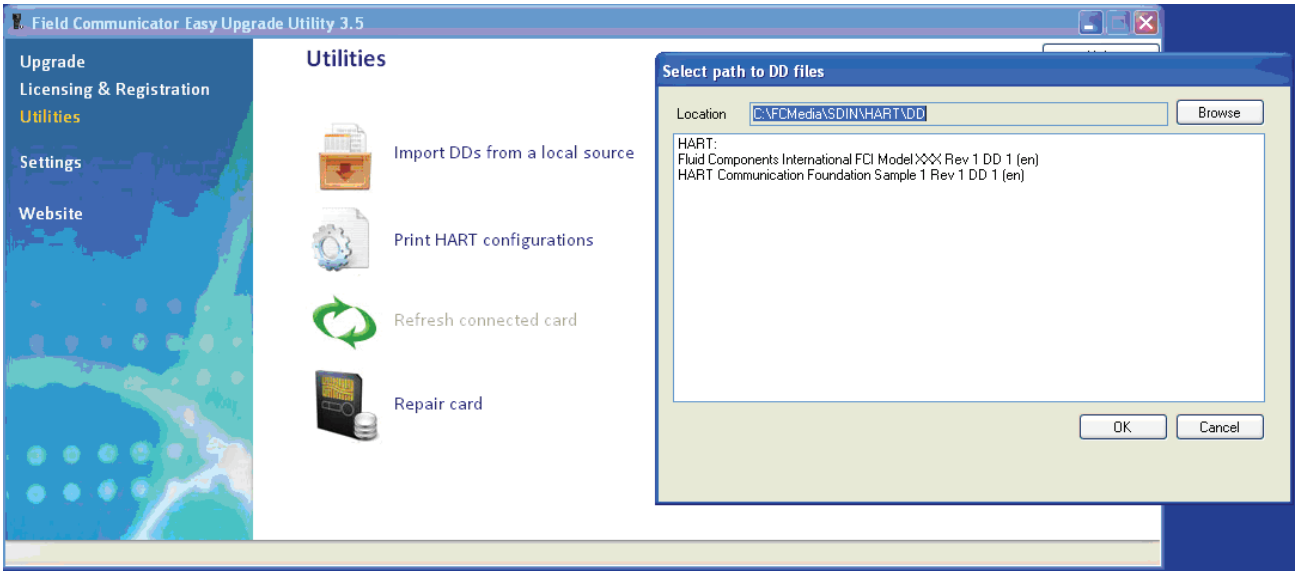
0101.fm8

A67F0101.ddl

Loading the DD Files to the 475 Field Communicator

In order to load the DDPs into the Field Communicator the "Easy Upgrade Utility from EMERSON must be used. Below is the procedure for how to load DD files into the 475-Field communicator.

Open Field Communicator Easy Upgrade Utility program and click Utilities on the left hand menu; select Import DDs from local source. The following window should pop up:



Select the FCI files and press "OK".

Service Data Operation

The Service Data functions are organized into 3 areas:

1. ST100 Basic Setup
2. ST100 Configuration
3. ST100 Factory Calibration Limits

The service information is presented here as seen through the 475 HART communicator, with FCI's EDDL files loaded. The same information seen by the 475 is shown in the DCS when the ST100 HART EDDL files are loaded.

ST100 Basic Setup

The Basic Setup function includes the ability to review and change the engineering units of the process variables, review and change the Plenum or pipe size, enable or disable the Totalizer, review and change device information, reset the operation of the ST100 to the factory settings, enable or disable the write protect, and PV Setup.

Engineering Units Information

Factory Reset

WARNING

The factory Reset command re-loads the configuration and calibration parameters that were loaded into the instrument during the original cal and setup. Any changes made to the configuration of calibration parameters will be lost when the Factory Reset command is executed.

ST100 Configuration

The configuration functions facilitate the setup of the individual 4 - 20 mA current output channels.

ST100 Calibration Limits (example)

The ST100 Calibration Limits function provide you with the ability to review the limits that have been set for each of the following process parameters: Flow, Temperature, and Pressure.

Setting the ST100 for the HART Protocol Operation

Note: If the ST100 was ordered as a 4-20 mA analog current output or a HART device, the factory will have configured the instrument for HART operation, and it should not be necessary to do any instrument configuration.

The ST100 PC Configurator tool is used to select the communication protocol with instrument power ON. In normal operating conditions, connect the PC with the configurator software to the ST100 USB port using FCI's cable (P/N 022646).

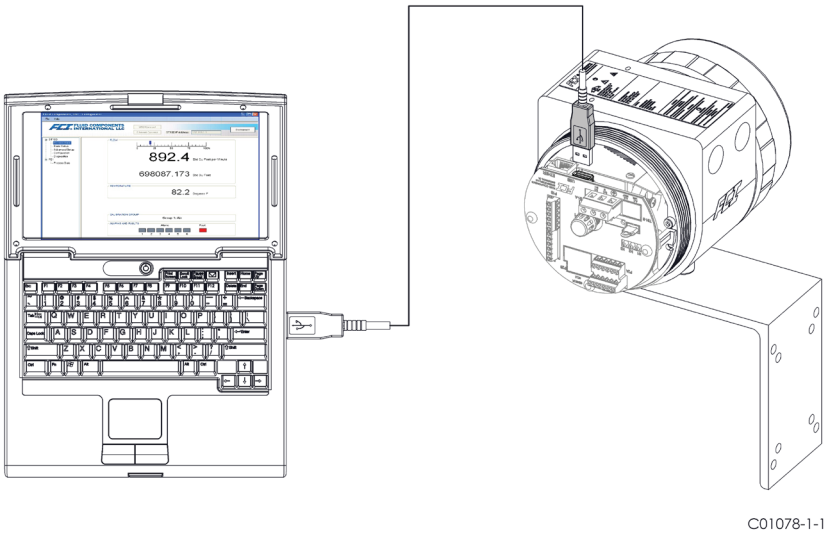
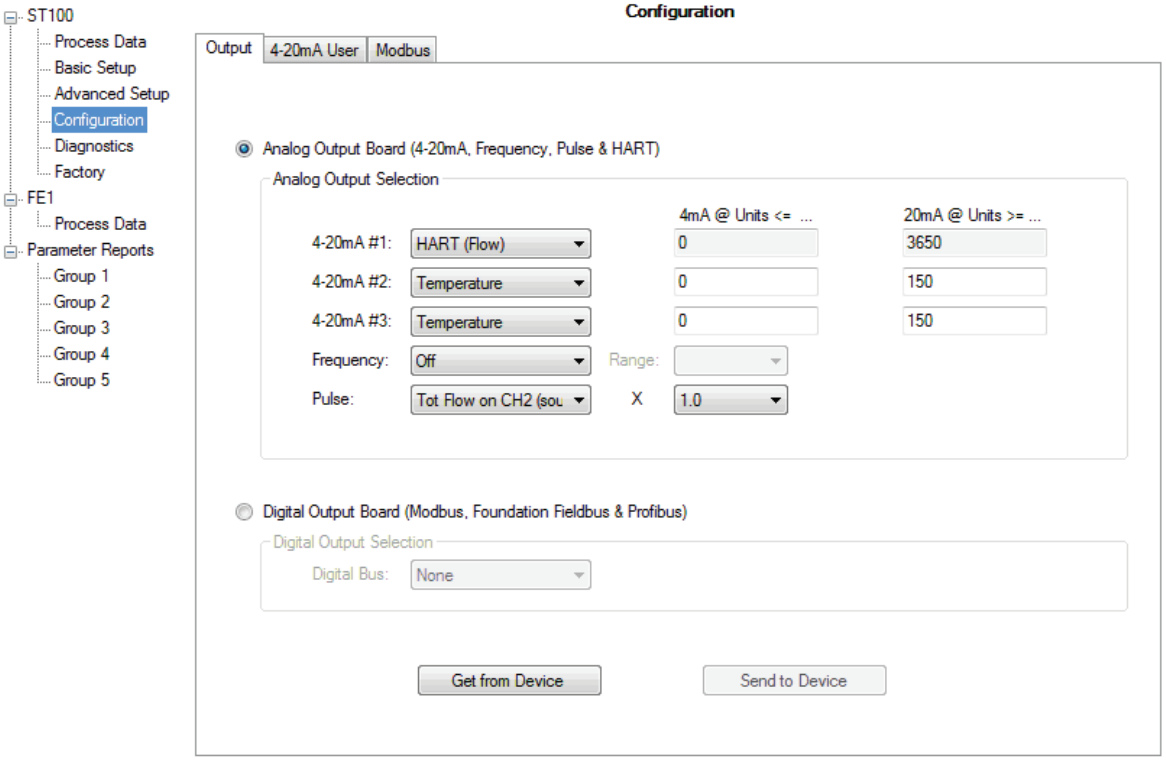


Figure 5 - Communication via the USB Port

To configure the ST100 for HART open the ST100 Configurator . From the tree menu, on the left side select "Configuration", and then select the "Output" tab. In the Output tab select "Analog Output Board" and then select "4-20mA channel #1 as HART". Verify the 4-20mA range values meet the process requirements. Then press the "Send to Device" button to download the setting to the ST100 instrument.



ST100 HART Command List

The ST100 HART commands are divided into the three groups.

1. Universal Commands
2. Common Practice Commands
3. Manufacturer Specific Commands.

ST100 HART Universal Commands

The ST100 HART supports Universal Commands 0 through 22. Commands 4 and 5 are reserved under Universal Command Specification Rev. 7.1 (HCF_SPEC-127, Revision 7.1) and not implemented in this specification. There is no hart command 10.

HART COMM NUMB.	HART COMMAND DESCRIPTION	HART DATA TYPE & SIZE
0	READ UNIQUE IDENTIFIER -	
	"254"	"254"
		UNSIGN (1 BYTE)
	EXPANDED DEVICE TYPE	EXPAND DEV TYPE
		ENUM (2 BYTE)
	MINIMUM PREAMBLES - REQUEST	MIN # PREAMBLES
		UNSIGN (1 BYTE)
	HART PROTOCOL MAJOR REV	HART PROTOCOL REV.
		UNSIGN (1 BYTE)
	DEVICE REVISION LEVEL	DEV. REV LEVEL
		UNSIGN (1 BYTE)
	DEVICE SOFTWARE REVISION LEVEL	SOFTWARE REV. LEVEL
		UNSIGN (1 BYTE)
	ELECTRONICS REVISION LEVEL (HARDWARE)	ELECTRONICS REV. LEVEL
		UNSIGN (1 BYTE)
	PHYSICAL SIGNALING CODE	STAK SOFT. REV
	CODE 0 = BELL 202 CURRENT	ENUM (1 BYTE)
	FLAGS	FLAGS
	CODE 01 = MULTI SENSOR	ENUM (1 BYTE)
	DEVICE ID	DEV. ID NUMB.
		UNSIGN (3 BYTES)
	MINIMUM PREAMBLES - RESPONSE	
		UNSIGN (1 BYTE)
	MAXIMUM # OF VARIBLES	MAX # VARIABLES
		UNSIGN (1 BYTE)
	CONFIGURATION CHANGE COUNTER	CONFIG CHANGE COUNT
		UNSIGN (2 BYTES)
	EXTENDED FIELD DEVICE STATUS	
		UNSIGN (1 BYTE)
	MANUFACTURER ID CODE	
	FCI CODE = 166 DEC (00A6)	ENUM (2 BYTES)

HART COMM NUMB.	HART COMMAND DESCRIPTION	HART DATA TYPE & SIZE
0	PRIVATE LABEL DIST. CODE	ENUM (2 BYTES)
	DEVICE PROFILE CODE	ENUM (2 BYTES)
1	READ PV VARIABLE (FLOW UNITS, & FLOW VALUE)	PV UNITS CODE CHAR (1 BYTE)
		PV VALUE FLOAT (4 BYTE)
2	READ PV CURRENT AND % RANGE	PV I VALUE (mA) FLOAT (4 BYTE)
		% PV VALUE FLOAT (4 BYTE)
3	READ PV CURRENT OUT & ALL DYNAMIC VARIABLES	PV I VALUE (mA) FLOAT (4 BYTE)
	FLOW UNITS	PV UNITS CODE CHAR (1 BYTE)
	FLOW VALUE	PV VALUE (4 BYTE)
6	WRITE NODE ID (WRITE POLLING ADDRESS)	POLLING ADDRS CHAR (1 BYTES)
		LOOP CUR MODE CHAR (1 BYTES)
7	READ LOOP CONFIGURATION	POLLING ADDRS CHAR (1 BYTES)
		LOOP CUR MODE CHAR (1 BYTES)
8	READ DYNAMIC VARIABLE CLASSIFICATIONS	ENUM (4 BYTES)
9	READ DEVICE VARIABLES WITH STATUS (UP TO 8 SLOTS)	
	EXTENDED FIELD DEVICE STATUS	BITMAP
	SLOT X DEV. VARIABLE CODE	UNSIGNED-8 (1 BYTE)
	SLOT X DEV. VARIABLE CLASS	ENUM (1 BYTE)
	SLOT X UNITS COD	ENUM (1 BYTE)
	SLOT X DEV. VARIABLE VALUE	FLOAT (4 BYTE)
	SLOT X DEV. VARIABLE STATUS	BITS (1 BYTE)

HART COMM NUMB.	HART COMMAND DESCRIPTION	HART DATA TYPE & SIZE
9	SLOT X DATA TIME STAMP (BYTES 65 - 68)	UNSIGNED-8 (4 BYTES)
11	READ UNIQUE IDENTIFIER ASSOCIATED W/TAG NOTE: SAME AS COMMAND "0" (SEE COMMAND "0")	UNIQ. ID (TAG) BITSTRING (12 BYTES)
12	READ USER MESSAGE	DEV. ID NUMB. BITSTRING (12 BYTES)
13	READ TAG READ DESCRIPTOR READ DATE CODE	TAG ASCII BIT STRING (6 BYTES) DESCRIPTOR ASCII BIT STRING (12 BYTES) DATE ASCII BIT STRING (5 BYTES)
14	READ PV SENSOR INFO SENSOR SERIAL NUMBER LIMITS UNITS CODE - PV UPPER SENSOR LIMIT - PV LOWER SENSOR LIMIT - PV MIN SPAN - PV	 SENSOR S/N UNSIGNED (3 BYTES) LIMITS UNITS CODES ENUM (1BYTE) UPPER SENSOR LIMIT FLOAT (4 BYTES) LOWER SENS LIMITS FLOAT (4 BYTES) MIN SPAN FLOAT (4 BYTES)
15	READ OUTPUT INFORMATION ALARM SELECT CODE TRANSFER FUNCTION CODE FLOW RANGE UNITS CODE FLOW UPPER-RANGE VAL FLOW LOWER-RANGE VAL FLOW DAMPING VALUE WRITE PROTECT CODE RESERVED (SET TO 250)	 ALRM SEL. CODE ENUM (1BYTE) TRN. FUNC. CODE CHAR (1BYTE) RNG UNITS CODE CHAR (1BYTE) UP RANG VALUE FLOAT (4 BYTES) LO RANG VALUE FLOAT (4 BYTES) DAMPING VALUE FLOAT (4 BYTES) W PROTECT CODE ENUM (1BYTE) RESERVED ENUM (1BYTE)

HART COMM NUMB.	HART COMMAND DESCRIPTION	HART DATA TYPE & SIZE
16	READ FINAL ASSEMBLY NUMBER ASSEMBLY NUMBER	ASSEMB. # UNSIGNED (3 BYTES)
17	WRITE MESSAGE MESSAGE	BITSTRING (24 BYTES)
18	WRITE TAG, DESCRIPTOR, DATE TAG DESCRIPTOR DATE	TAG BITSTRING (6 BYTES) DESCRIPTOR BITSTRING (12 BYTES) DATE CHAR (3 BYTES)
19	WRITE FINAL ASSEMBLY NUMBER ASSEMBLY NUMBER	ASSEMB. # UNSIGNED (3 BYTES)
20	READ LONG TAG LONG TAG	LONG TAG BITSTRING (32 BYTES)
21	READ UNIQUE INDENTIFIER ASSOCIATED WITH LONG TAG UNIQUE IDENTIFIER	UNIQ. ID BITSTRING (32 BYTES)
22	WRITE LONG TAG LONG TAG	LONG TAG BITSTRING (32 BYTES)

ST100 HART Common Practice Commands

The ST100 HART supports Common Practice commands 35, 38, 40, 42, 44, 45, 46, 48, 50, and 51.

HART COMM NUMB.	HART COMMAND DESCRIPTION	HART DATA TYPE & SIZE
35	WRITE PV RANGE VALUES UPPER RANGE VALUE LOWER RANGE VALUE	 RNG UNITS CODE UNSIGN (1BYTE) UPPER-RNG VAL FLOAT (4 BYTES) LOWER-RANGE VALUE FLOAT (4 BYTES)
38	RESET "CONFIGURATION CHANGE" FLAG	RESET CONFIG. CHANGE. FLAG UNSIGN (1BYTE)
40	ENTER/EXIT FIXED CURRENT MODE (IN mA) Value =0 means exit fixed current mode	I MODE SELECT FLOAT (4 BYTES)
42	PERFORM DEVICE RESET	 RESET INSTRUM. UNSIGN (1BYTE)
44	WRITE PV UNITS	 PV UNITS CODE ENUM (1BYTE)
45	TRIM DAC ZERO - MEASURED CURRENT CHAN #1 IN (mA)	 TRIM_DAC_ZERO FLOAT (4 BYTES)
46	TRIM DAC GAIN - MEASURED CURRENT CHAN #1 IN (mA)	 TRIM_DAC_GAIN FLOAT (4 BYTES)
48	READ ADDITIONAL DEVICE STATUS DEVICE-SPECIFIC STATUS EXTENDED DEVICE STATUS DEVICE OPERATING MODE STANDARIZED STATUS 0 STANDARIZED STATUS 1 ANALOG CHAN SATURATED STANDARIZED STATUS 2	25 BYTES 6 BYTES 1 BYTE 1 BYTE 1 BYTE 1 BYTE 1 BYTE 1 BYTE

HART COMM NUMB.	HART COMMAND DESCRIPTION	HART DATA TYPE & SIZE
48	STANDARIZED STATUS 3	1 BYTE
	ANALOG CHAN FIXED	1 BYTE
	DEVICE SPECIFIC STATUS	11 BYTES
50	READ DYNAMIC VARIABLE ASSIGNMENTS	
	PRIMARY DEVICE VARIABLE	1 BYTE
	SECONDARY DEVICE VARIABLE	N/A
	TERTIARY DEVICE VARIABLE	N/A
	QUATERNARY DEVICE VARIABLE	N/A
51	WRITE DYNAMIC VARIABLE ASSIGNMENTS	1 BYTE
	PRIMARY DEVICE VARIABLE	1 BYTE
	SECONDARY DEVICE VARIABLE	N/A
	TERTIARY DEVICE VARIABLE	N/A
	QUATERNARY DEVICE VARIABLE	N/A

ST100 HART Manufacturer Specification Commands

The ST100 HART supports 20 Manufacturer Specific commands.

HART COMM NUMB.	HART COMMAND DESCRIPTION	HART DATA TYPE & SIZE
137	READ TOTALIZER VALUE	READ TOTALIZER FLOAT (4BYTES)
138	READ TOTALIZER STATE	READ TOT STATE UNSIGN (1 BYTE)
139	WRITE TOTALIZER STATE	READ TOT STATE UNSIGN (1 BYTE)
140	READ DEVICE INFORMATION	
	DEVICE CO	DEVICE CO ASCII BITSTRING (10 BYTES)
	DEVICE SERIAL NUMBER	DEVICE S/N ASCII BITSTRING (10 BYTES)
	DEVICE SOFTWARE VER	DEV SOFTW VER ASCII BITSTRING (4 BYTE)
159	WRITE FACTORY RESTORE	FACT_RESTORE ENUM (1 BYTE)

HART COMM NUMB.	HART COMMAND DESCRIPTION	HART DATA TYPE & SIZE
145	READ CUSTOMER ENGINEERING UNITS	
	FLOW UNITS CODE	FLOW CODE UNSIGN (1 BYTE)
	TEMPERATURE UNITS CODE	TEMP CODE UNSIGN (1 BYTE)
	TOTALIZER UNITS CODE	TOTAL CODE UNSIGN (1 BYTE)
	PRESSURE UNITS CODE	PRESS CODE UNSIGN (1 BYTE)
146	WRITE CUSTOMER ENGINEERING UNITS	
	FLOW UNITS CODE	FLOW CODE UNSIGN (1 BYTE)
	TEMPERATURE UNITS CODE	TEMP CODE UNSIGN (1 BYTE)
	TOTALIZER UNITS CODE	TOTAL CODE UNSIGN (1 BYTE)
	PRESSURE UNITS CODE (optional)	PRESS CODE UNSIGN (1 BYTE)
148	READ PLENUM INFORMATION (PIPE SIZE)	
	PLENUM HEIGHT VALUE	PIPE_HEIGHT FLOAT (4BYTES)
	PLENUM WIDTH (DIAM) VALUE	PIPE_WIDTH FLOAT (4BYTES)
	PLENUM UNITS CODE	PIPE_CODE UNSIGN (1 BYTE)
149	WRITE PLENUM INFORMATION (PIPE SIZE)	
	PLENUM HEIGHT VALUE	PIPE_HEIGHT FLOAT (4BYTES)
	PLENUM WIDTH (DIAM) VALUE	PIPE_WIDTH FLOAT (4BYTES)
	PLENUM UNITS CODE	PIPE_CODE UNSIGN (1 BYTE)
150	WRITE "WRITE PROTECT" MODE	WRITE_PROT UNSIGN (1 BYTE)

HART COMM NUMB.	HART COMMAND DESCRIPTION	HART DATA TYPE & SIZE
160	WRITE (4-20mA) OUTPUT CHANNEL #1 PARAMETERS	
	D/A SETTING FOR 4mA OUT	OUTZ1 UNSIGN (2BYTES)
	D/A SETTING FOR 20mA OUT	OUTF1 UNSIGN (2BYTES)
	CHANNEL #1 OUT VARIABLE	CHA_1_PRO_VAR UNSIGN (1 BYTE)
161	READ (4-20mA) OUTPUT CHANNEL #1 PARAMETERS	
	D/A SETTING FOR 4mA OUT	OUTZ1 UNSIGN (2BYTES)
	D/A SETTING FOR 20mA OUT	OUTF1 UNSIGN (2BYTES)
	CHANNEL #1 OUT VARIABLE	CHA_1_PRO_VAR UNSIGN (1 BYTE)
163	WRITE (4-20mA) OUTPUT CHANNEL #2 PARAMETERS	
	D/A SETTING FOR 4mA OUT	OUTZ2 UNSIGN (2BYTES)
	D/A SETTING FOR 20mA OUT	OUTF2 UNSIGN (2BYTES)
	CHANNEL #2 OUT VARIABLE	CHA_2_PRO_VAR UNSIGN (1 BYTE)
164	READ (4-20mA) OUTPUT CHANNEL #2 PARAMETERS	
	D/A SETTING FOR 4mA OUT	OUTZ2 UNSIGN (2BYTES)
	D/A SETTING FOR 20mA OUT	OUTF2 UNSIGN (2BYTES)
	CHANNEL #2 OUT VARIABLE	CHA_2_PRO_VAR UNSIGN (1 BYTE)
166	WRITE (4-20mA) OUTPUT CHANNEL #3 PARAMETERS	
	D/A SETTING FOR 4mA OUT	OUTZ3 UNSIGN (2BYTES)
	D/A SETTING FOR 20mA OUT	OUTF3 UNSIGN (2BYTES)
	CHANNEL #3 OUT VARIABLE	CHA_3_PRO_VAR UNSIGN (1 BYTE)
167	READ (4-20mA) OUTPUT CHANNEL #3 PARAMETERS	
	D/A SETTING FOR 4mA OUT	OUTZ3 UNSIGN (2BYTES)
	D/A SETTING FOR 20mA OUT	OUTF3 UNSIGN (2BYTES)
	CHANNEL #3 OUT VARIABLE	CHA_3_PRO_VAR UNSIGN (1 BYTE)

HART COMM NUMB.	HART COMMAND DESCRIPTION	HART DATA TYPE & SIZE
170	READ BANK #1 OF SENSOR VARIABLES	
	FLOW VALUE -SENSOR #1	FLOW1_VAL
		FLOAT (4BYTES)
	TEMPERATURE VAL SENSOR#1	TEMP1_VAL
		FLOAT (4BYTES)
	PRESSURE VALUE SENSOR#1	PRESS1_VAL
		FLOAT (4BYTES)
	FLOW VALUE -SENSOR #2	FLOW2_VAL
		FLOAT (4BYTES)
	TEMPERATURE VAL SENSOR#2	TEMP2_VAL
		FLOAT (4BYTES)
	PRESSURE VALUE SENSOR#2	PRESS2_VAL
		FLOAT (4BYTES)
	FLOW VALUE -SENSOR #3	FLOW3_VAL
		FLOAT (4BYTES)
	TEMPERATURE VAL SENSOR#3	TEMP3_VAL
		FLOAT (4BYTES)
	PRESSURE VALUE SENSOR#3	PRESS3_VAL
		FLOAT (4BYTES)
	FLOW VALUE -SENSOR #4	FLOW4_VAL
		FLOAT (4BYTES)
	TEMPERATURE VAL SENSOR#4	TEMP4_VAL
		FLOAT (4BYTES)
	PRESSURE VALUE SENSOR#4	PRESS4_VAL
		FLOAT (4BYTES)
151	READ CAL FLOW LIMITS	
	FLOW LOWER LIMIT	FLOW_LO_LIM
		FLOAT (4BYTES)
	FLOW UPPER LIMIT	FLOW_UP_LIM
		FLOAT (4BYTES)
154	READ CAL TEMP. LIMITS	
	TEMPERATURE LOWER LIMITS	TEMP_LO_LIM
		FLOAT (4BYTES)
	TEMPERATURE UPPER LIMITS	TEMP_UP_LIM
		FLOAT (4BYTES)
157	READ CAL PRESS. LIMITS	
	PRESSURE LOWER LIMIT	PRESS_LO_LIM
		FLOAT (4BYTES)
	PRESSURE UPPER LIMIT	PRESS_UP_LIM
		FLOAT (4BYTES)

Technical Characteristics

Manufacture ID:	0XA67F
Output Signal:	4 to 20 mA signal via a FSK modem/ HI311 HART PC Interface
Data transmission rate:	1200Hz
Signal coding:	Bell 202 Current (Physical layer)
Supported communication:	Publisher, Subscriber
HART Commands:	Universal Commands Common Practice Commands Manufacturer Specification Commands
Certification:	Hart Communication Foundation Registered
Register Features:	Alarms and Events Relays Muti-bit Alert Reporting Field Diagnostics

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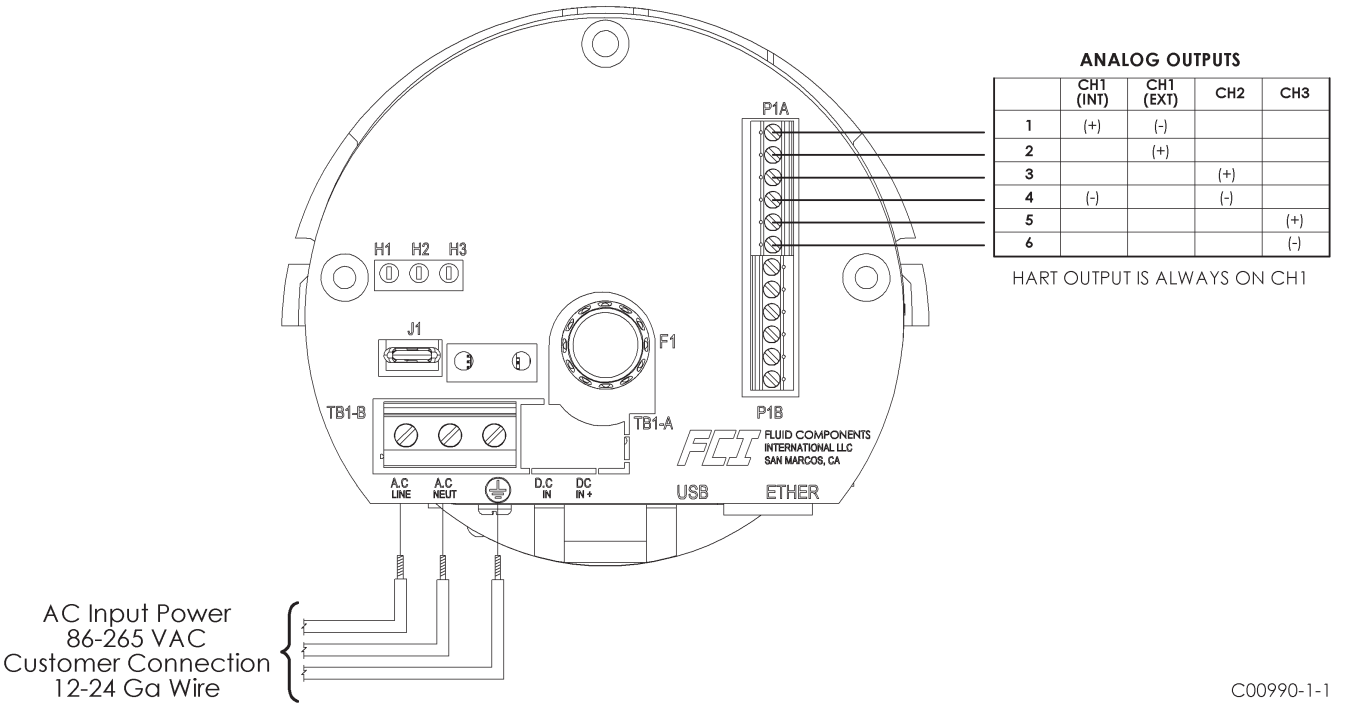
Appendix A – Drawings



Channel 1 HART Connection
Before April 2012

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Appendix B – Customer Service / Technical Support

FCI provides full in-house technical support. Additional technical representation is also provided by FCI field representatives.

By Mail

Fluid Components International LLC

1755 La Costa Meadows Dr.

San Marcos, CA 92078-5115 USA

Attn: Customer Service Department

By Phone

Contact the area FCI regional representative. If a field representative is unable to be contacted or if a situation is unable to be resolved, contact the FCI Customer Service Department toll free at 1 (800) 854-1993.

By Fax

To describe problems in a graphical or pictorial manner, send a fax including a phone or fax number to the regional representative. Again, FCI is available by facsimile if all possibilities have been exhausted with the authorized factory representative. Our Fax number is 1 (760) 736-6250; it is available 7 days a week, 24 hours a day.

By E-Mail

FCI Customer Service can be contacted by e-mail at: techsupport@fluidcomponents.com.

Describe the problem in detail making sure a telephone number and best time to be contacted is stated in the e-mail.

International Support

For product information or product support outside the contiguous United States, Alaska, or Hawaii, contact your country's FCI International Representative or the one nearest to you.

After Hours Support

For product information visit FCI at www.fluidcomponents.com. For product support call 1 (800) 854-1993 and follow the prerecorded instructions.

Point of Contact

The point of contact for service, or return of equipment to FCI is your authorized FCI sales/service office. To locate the office nearest you, please go to www.fluidcomponents.com.

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ISO 9001 and AS9100 Certified

Visit FCI on the Worldwide Web: www.fluidcomponents.com

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